

140. On a Limestone with Favosites from Erh-tao-kou, West of Kirin, Manchuria.

(Preliminary Report)

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A small lense of limestone, exposed at Erh-tao-kou (Nidokô)¹⁾, 15 km west of Kirin (Kiturin), Manchuria, was found this summer by Messrs. T. Yosida, M. Goisi and K. T. Li to be fossiliferous. This limestone which belongs to a thick complex, known in the Manchurian geology as the "Kiturin formation", occurs in the type locality of the formation.

The name "Kiturin formation" was first used by Mr. M. Kawada in his Explanatory Text to the Geological Map, Kiturin Sheet²⁾, for a complex of enormous thickness, composed chiefly of sandstones, slates, and breccias, all often metamorphosed to hornfels. In addition to these, it comprises in its lower and middle divisions, also limestones in small lenses or thin beds, which are developed to a considerable thickness in its upper division. Based on his finds of stem-joints of crinoids in a limestone of Shih-hwei-yao-tze³⁾, and certain corals in another limestone of Yen-tung-shan⁴⁾, he assumed the formation to be Permocarboniferous age, although in doing so he had in mind the possibility of its lower part being Devonian or Silurian. This formation, which seems to be widely distributed in northern and eastern Manchuria, is in certain sense, comparable to the Titibu system of Japan.

Thanks to the later efforts of Messrs. H. Ozaki⁵⁾, S. Okada⁶⁾, R. Saito⁷⁾ and especially of M. Minato⁸⁾, it is now known from palaeontological evidences, that several geological horizons, ranging from Lower Carboniferous to Permian, are represented in the Kiturin formation. The important fossils, the fossil localities, and the geological ages of the respective horizons will be found listed below :

1) 二道溝

2) M. Kawada: Explanatory Text to the Geological Map of Manchuria, Chilin (in Japanese), 1932, pp. 3-6.

3) 石灰窖子

4) 煙筒山

5) H. Ozaki: Foraminifera from the Kirin Bed. Jour. Geol. Soc. Japan, vol. 48, No. 568, p. 51, 1941.

6) S. Okada: Limestone in Chilin Formation near Mincheng, Panshihhsien, Chilin Province (in Japanese). Mem. Geol. Inst. Manchoukuo, No. 15, p. 1, 1940.

7) N. Saito: On Some Fossils from Chilin Formation near Mincheng (in Japanese) Mem. Geol. Inst. Manchoukuo, No. 15, p. 65, 1940.

8) M. Minato: Unterkarbonfauna in der Mandschurei (vorläufige Mitteilung) Bull. Geol. Inst. Manchoukuo, No. 106, pp. 27-46, 1942. Notes on Some Lower Carboniferous Fossils from the Kirin Formation in Mincheng, Panshihhsien, Prov. Kirin, Manchoukuo. Jour. Fac. Sci., Hokkaido Imp. Univ., ser. 4, vol. 7, No. 1, 1943. Also R. Toriyama and M. Minato: *Pseudoschwagerina*-Vorkommen in Kirin-Formation (Mandschurei). Jour. Geol. Soc. Japan, vol. 50, No. 601, p. 312, 1943.

Fossils from the Kiturin Formation

Foraminifera

<i>Tetrataxis</i> cf. <i>conica</i> Ehrenberg	Near Yen-tung-shan (Ozaki), Moscovian
<i>Endothyra</i> sp.	Lu-chuan-tze ⁹⁾ near Min-cheng ¹⁰⁾ (Minato, 1942), Lower Carboniferous
<i>Fusulinella</i> sp.	Near Yen-tung-shan (Ozaki), Moscovian
<i>Staffella</i> sp.	Do.
<i>Pseudoschwagerina</i> sp.	Tung-lu-chuan-tze ¹¹⁾ near Mincheng (Toriyama and Minato), Sakmarian

Tetracoralla

<i>Siphonodendron asiatica minor</i> Minato	Lu-chuan-tze and Tung-lu-chuan-tze, both near Min-cheng (Minato, 1942, 1943), Lower Carboniferous
<i>Auloclisia</i> sp. nov.?	Tung-lu-chuan-tze (Minato, 1942), Lower Carboniferous
<i>Clisazophyllum</i> sp. a, nov.?	Lu-chuan-tze (Minato, 1942), Lower Carboniferous
<i>Clisazophyllum</i> sp. b, nov.?	Do.
<i>Clisazophyllum</i> sp. c, nov.?	Do.
<i>Dibunophyllum</i> sp. a, nov.?	Do.
<i>Dibunophyllum</i> sp. b, nov.?	Do.
<i>Dibunophyllum</i> ? sp.	Do.
<i>Lonsdaleia floriformis floriformis</i> Martin	Tung-lu-chuan-tze (Minato, 1942), Lower Carboniferous
<i>Carcinophyllum</i> sp.	Lu-chuan-tze (Minato, 1942), Lower Carboniferous
<i>Caninia</i> sp.	Tung-lu-chuan-tze (Minato, 1942), Lower Carboniferous
<i>Diphyphyllum</i> sp.	Lu-chuan-tze (Minato, 1942), Lower Carboniferous
<i>Palaeosmilina</i> ? sp.	Do.
<i>Syringopora</i> sp.	Near Panshih ¹²⁾ (Kobayashi) ¹³⁾ , Lower Carboniferous
Bryozoa	
<i>Fenestella</i> sp.	6 km S. of Lu-chuan-tze (Minato, 1942), Lower Carboniferous?
Brachiopoda	
<i>Productus</i> (<i>Gigantella</i>) <i>latissimus</i> Sowerby	Lu-chuan-tze (Minato, 1943), Lower Carboniferous
<i>Productus</i> (<i>Gigantella</i>) <i>manchuriensis</i> Minato	Do.
<i>Plicatifera</i> sp. a	6 km S. of Lu-chuan-tze (Minato, 1942), Lower Carboniferous?
<i>Plicatifera</i> sp. b.	Do.
<i>Orthotetes</i> sp.	Do.

Kawada called attention to the frequent intercalations of small limestone lenses in breccias lying in the middle and lower divisions of the Kiturin formation. The fossiliferous limestone of Erh-tao-kou is one of these lenses, being in part rich in stem-joints of crinoids, and

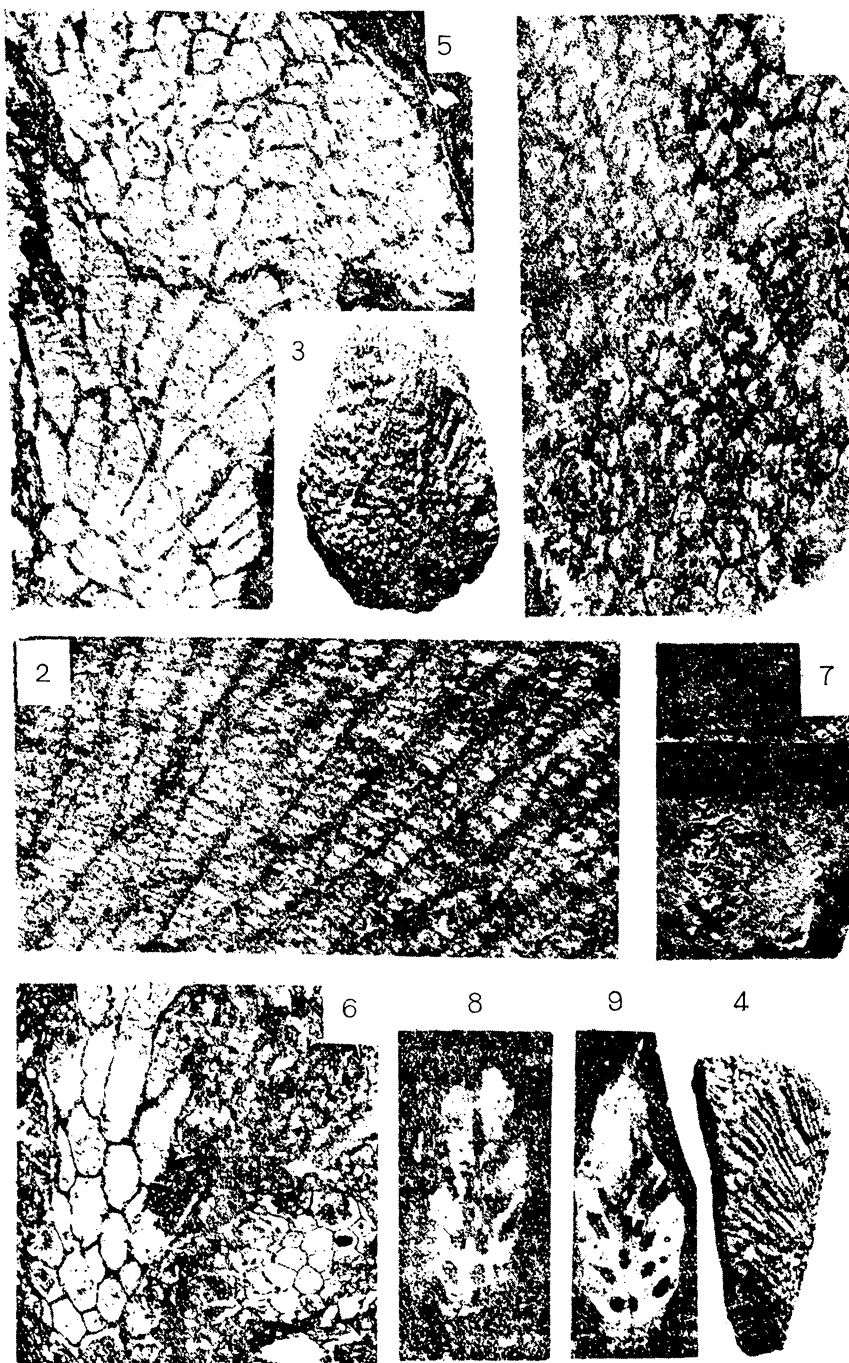
9) 東鹿圈子

10) 明城

11) 鹿圈子

12) 盤石

13) T. Kobayashi: Sakawa Orogenic Cycle. Jour. Fac. Sci. Imp. Univ. Tokyo, sec. 2, vol. 5, pt. 7, 1941.



Figs. 1-5. *Favosites* sp. nov. 1-4, the holotype; 1, transverse section, $\times 5$; 2 longitudinal section, $\times 5$; 3 and 4, natural size; 5, another specimen, $\times 5$.

Figs. 6 and 7. Cf. *Striatopora cristata* (Blumenbach). 6, $\times 5$; 7, weathered surface of the specimen, of which the middle part is used for making the thin section (Fig. 6).

Figs. 8 and 9. *Cladopora?* sp., in longitudinal section, $\times 9$.

exposed not very far north-east of the limestone of Shih-hwei-yao-tze, in which he once found similar remains. That it belongs to the Kiturin formation there is no possible doubt.

The limestone of Erh-tao-kou is partly very impure, being rich in clastic material, and some of the fossiliferous samples collected by Yosida and others might better be called calcareous sandstone or breccia. The fossils in them are not in good condition, the corals to be mentioned below being all in fragments, although their inner structure is fairly well preserved and favourable for microscopical examination, and by this means, a species each of the genera *Favosites*, *Striatopora* (or *Thamnopora*), *Cladopora*? and *Aulopora*?, have been determined from the numerous fragments. The only other fossil found in the same material is a brachiopod shell, resembling *Atrypa*. Description of coral remains discriminated follows.

Favosites sp. nov. Figs. 1-5. Corallum small, massive, probably globular or pyriform, up to 30 mm broad and 50 mm high. A more or less worn, rounded individuum, size $48 \times 30 \times 20$ mm, is taken as the holotype (figs. 1-4).

Corallites narrow, prismatic, all in complete contact, disposed vertically in the axial part of corallum, diverge upwards, finally becoming normal to its surface, variably broad, small (0.75 mm) and the large (up to 1.5 mm) ones distributed irregularly, rather uniformly broad throughout their length; in cross-section, polygonal (usually hexagonal), bordered by walls which are 0.2 mm thick in average, provided with a median dark line, and interrupted by 1 or 2 mural pores 0.15-0.2 mm broad; in longitudinal section, almost parallel-sided and traversed by numerous very thin tabulae, which are horizontal, complete, and in general uniformly distributed, numbering 7-8 per 2 mm, except near the surface of corallum where they are densely crowded up to 10 per 2 mm. Squamulae or incomplete tabulae absent. Septal spines rarely preserved, probably sparse and irregular in distribution; when visible, rather thick and directed obliquely upwards.

Remarks: Beside the corallum on which the above description is based, a large number of fragments are embedded in the same limestone; the walls of the corallites in some of them are somewhat thicker than in the holotype, but never so thickened as in *Thamnopora* or *Pachypora*; in all other features they agree well with it.

By its narrow corallites with crowded tabulae at rather regular intervals, this species closely resembles *Favosites multitabulata* Etheridge¹⁴ from the Devonian and *F. yassoensis* Jones¹⁵ from the Silurian, both of Australia. In *F. multitabulata*, however, the corallites are somewhat broader and crossed by tabulae disposed more irregularly, while in *F. yassoensis*, they are narrower and uniform in size, and provided with numerous short septal spines.

14) C. A. Jones: The Australian Massive Species of the Coral Genus *Favosites*. Rec. Austral. Mus., vol. 20, p. 97, pl. 16, figs. 1, 2, 1937.

15) C. A. Jones: Op. cit., p. 92, pl. 13, figs. 2, 3.

Favosites multispinosus Yabe and Sugiyama¹⁶⁾ from the Devonian of Heitai, Manchuria, consists of more uniformly sized corallites, with numerous septal spines and less crowded tabulae.

Possibly the specimens at disposal represent a new species of *Favosites*, but we shall not name it here, awaiting more suitable material in the near future.

The originals are preserved in the Institute of Geology and Palaeontology, Tôhoku Imperial University, Reg. No. 65973.

Cf. *Striatopora cristata* (Blumenbach). Figs. 6, 7. There are many fragments of slender cylindrical coralla, all firmly embedded in the matrix, from which it is not easily separable; rarely the surface features of the coralla are visible as impressions, but the details are lost by weathering. The external aspect of the calices being not well recognizable it is impossible to determine the precise generic position of this fossil; the following accounts are mostly based on examinations of thin sections cut in various directions.

Corallum slender, cylindrical, straight, 5–6 mm broad and 40–50 mm long. Corallites prismatic, contiguous, almost vertical in axial part of corallum, thence diverge outwards, finally ending oblique to the surface; variably broad, narrow (0.57 mm diameter), the broader (1.2 mm or slightly less broad) ones intermingled without order; in the cross-section of the axial part of corallum, polygonal, being usually 4- to 6-sided, 0.4–0.86 mm broad, and surrounded by relatively thick wall (0.5 mm or slightly more), which has a distinct median line between the stereoplasmic deposits on either side. Wall thickened considerably toward the calices, which are shallow, rounded, and not uniformly broad. Mural pores few, relatively large; tabulae few, irregular, and wide apart.

Remarks: This fossil, which may belong either to *Thamnopora* or to *Striatopora*, approaches more closely the latter genus than the former, in having oblique calices. It agrees fairly well with *Striatopora cristata*, figured by Yabe and Hayasaka¹⁷⁾ from the Devonian of Laosai-tai, Hsing-an-hsien, Kwangsi¹⁸⁾, South China, which latter was thought by them to be indistinguishable from the European specimens called *Favosites cristata* by Frech and *Striatopora cristata* by Gürich. Le Compte¹⁹⁾ has recently pointed out in his revision of the type specimens Goldfuss' of *Favosites* that *Favosites cristata* of Goldfuss and *F. dubia* (de Blainville) may be identical. Comparing the present fossil with the one from South China, both corallum and corallites are more slender in the former than in the latter, slight differences, which, however, may be of little value for specific distinction.

16) H. Yabe and T. Sugiyama: Devonian Fossils from Heitai, Mishan-hsien, Manchoukuo. Proc. Imp. Acad. Japan, vol. 18, No. 6, p. 324, figs. 4a-d, 1942.

17) H. Yabe and I. Hayasaka: Geographical Research in China, 1911–1916, vol. 3, 1920, p. 129, pl. 12, fig. 3; pl. 19, fig. 11.

18) 廣西省興安縣老茶亭

19) M. Le Compte: Revision des Tabulés Dévoniens décrits par Goldfuss. Mém. Mus. Roy. d'Hist. Nat. Belg., No. 75, p. 567, 1936.

The reference of the South Chinese and Manchurian fossils to the genus *Striatopora* remains provisional, until it is possible to confirm that they possess cup-shaped calices with radial striae on the bottom, characteristic of the genus.

On the other hand, the fossil also strongly resembles *Favosites cervicornis* (de Blainville), redescribed by Le Compte²⁰⁾, which is a *Thamnopora*. The latter, however, possesses less oblique, deeper calices, bordered by less thickened walls.

The original is stored in the Institute of Geology and Palaeontology, Tôhoku Imperial University, Reg. Nos. 65975, 65979.

Cladopora? sp. Figs. 8, 9. Corallum cylindrical, very slender, nearly 15 mm long, 1.5–2 mm broad, round in cross-section; probably branching. None of the individuals being separable from the matrix, the surface features are unknown, except those in which inferences can be made from examination of polished surfaces and thin sections.

Corallites cylindrical, separated by relatively thick walls, narrow, 0.18 mm broad, round in cross-section, diverge upwards from axial part of corallum, running quite oblique to its surface, disposed regularly in 6 or 8 parallel vertical rows. Tabulae present, rather few, irregularly distributed. Septa absent, mural pores few. In longitudinal section of corallum, its borders appear cusped regularly, showing relatively broad, expanded calices which may be polygonal rather than round in outline, with thick walls that acuminate above to sharp edges.

Remarks: This is a slender ramose species, possibly of the genus *Cladopora*, and in certain respects resembling such forms as *Cladopora labiosa* (Billings)²¹⁾ from the Columbus limestone of Ohio, North America, and other simulants.

Found in the same piece of the limestone with Cf. *Striatopora cristata* Reg. No. 65975.

Aulopora? sp. A small colony of a very slender form, possibly of *Aulopora*, was found on polished surface of the limestone with Cf. *Striatopora cristata* and *Cladopora?* sp., Reg. No. 65975. It consists of several elongate conical corallites, arranged in manner characteristic of the genus, and apparently terminated at the round calices 0.5 mm across. Seen in thin section, the corallites are provided with rather thick walls, which are 0.25 mm thick and smooth externally; they have neither septa nor tabulae.

It will be seen from the foregoing study that the Erh-tao-kou limestone contains a small assemblage of fossil corals, consisting of

Favosites sp. nov.

Cf. *Striatopora cristata* (Blumenbach)

Cladopora? sp.

Aulopora? sp.

20) M. Le Compte: Op. cit., p. 20.

21) G. A. Stewart: Middle Devonian Corals. Geol. Surv., U. S. A., Sp. P., No. 8, p. 73, pl. 17, figs. 4–7, 1938.

The precise geological age of the coral faunule is difficult to settle, being very limited in the number of species and lacking elements identical with those previously known and characterizing some definite horizon. Its close affinity in general aspect to Devonian coral faunas, however, is indisputable, furnishing conclusive evidence of the presence in the Kiturin formation of a geological horizon older than the Lower Carboniferous, as once suspected by Kawada.